PennDOT LTAP
technical
INFORMATION
SHEET #187
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DUST BUSTING

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Dust from unpaved roads can be troublesome for motorists and burdensome in terms of maintenance headaches and costs to your municipality. You can control dust and save money in the process by properly installing good aggregate (stone or gravel), appropriately applying dust suppressants, strategically placing geosynthetics, and performing routine maintenance.

This tech sheet will cover obtaining and properly installing quality aggregate, preparing the road with proper maintenance, and choosing and appropriately applying dust suppressants. Selecting and placing geosynthetics is covered in another tech sheet.

Motorists don't like to see dust from unpaved roads. Municipalities can control dust by installing good aggregate, applying dust suppressants, and performing routine maintenance.

Sign of the Fines

Dust in the air above your unpaved roads is a sign that the fine particles (the "fines") that were included in the aggregate mixture you purchased are escaping. Fines also result from traffic grinding the larger stones in the aggregate mixture into smaller pieces.

Fines are the "Elmer's glue" of the aggregate mixture and are to unpaved roads what asphalt is to bituminous roads. When the fines are moist at the time of placement and remain moist, they help interlock the stones in the aggregate mixture to create a hard, stable surface for traffic. When the fines are dry at placement or dry out later, they immediately begin to blow away as dust. During a year, literally tons of your fine aggregate are carried off on the wind.

If you don't reblend the road surface to bring more fines to the surface or if you fail to install more fines and aggregate, as needed, you'll also lose larger stones as vehicles kick them from the road onto the shoulders and into the ditches.

Frequent repair of potholes, washboards, and washouts; the need to regrade the road's crown, which is essential for proper drainage; and replacing aggregate and fines that have migrated into your ditches and storm sewers can be costly to your township, and you will want to prolong these occurrences for as long as possible.

Obtaining Quality Aggregate

Aggregate for the wearing surface of unpaved roads must be hard, durable, moist, and of appropriate gradation (containing proper percentages of stones of different sizes, from large stones down to the fines). Often, aggregate you obtain from the quarry does not contain enough fines or moisture.

Buying aggregate per the recommendations below will help reduce the loss of fines and stones from your unpaved roads, minimize repair, prolong service life, and encourage a hard, stable surface with proper cross-slope (crown) to be created:

- Aggregate should be granular and have gone through the quarry process of crushing and fracturing.
- Aggregate should be well graded, from coarse (larger) stones down to the fines.
- Fines should make up 8 to 15 percent of the aggregate mixture by weight.
- Aggregate should be free of vegetation.
- Individual stones of the aggregate mixture should be hard, such as stones from limestone found in Pennsylvania. (The Los Angeles Abrasion Test will help to determine hardness.)
- The pH value determined for the aggregate should be in the neutral-to-alkaline range.

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Dust control won't make a bad road good, **but it will keep a good road in decent shape.**

pH is a measure of the acidity or alkalinity of a solution, with 7 being the reading for a neutral solution; higher readings indicate alkalinity, and lower readings acidity. Limestone-water solutions produce alkaline readings. Using aggregate that produces alkaline readings will help maintain the pH balance of roadside streams, since rainwater drains through the aggregate and enters the streams, sometimes carrying fines and stones with it. In Pennsylvania, many streams are becoming more acidic from acid rain and run-off, and increasing acidity negatively affects stream life.

- Aggregate should be moist, not dry or saturated with water, to allow its proper compaction.

Once you find aggregate that meets the recommendations, ensure that it remains moist during delivery. When you order aggregate, specify that:

- Aggregate be delivered at its optimum moisture content. (Work with your supplier to determine the best moisture content for the use and compaction that you plan for the aggregate.)
- Tarps cover 100 percent of the aggregate's exposed surface from the time it is loaded until immediately before the truck dumps it. (That includes the time the truck is waiting to dump.)

Preparing the Road

Before you place the aggregate, or before you apply a dust suppressant for that matter, you must perform routine maintenance on the road as well as more serious repair, if necessary. Technical Information Sheet #186, Maintaining Gravel Roads, details the maintenance activities of blading and reshaping the road with a motor grader. These activities, which should be performed when the road is moist, are outlined below:

- Routine blading may be all the maintenance required to reblend and smooth the road surface so that the fines and stones can interlock to form a hard wearing surface. Even when dust is controlled, the surface of an unpaved road will break down over time from weather and traffic and will require reblending and smoothing.
- Reshaping may be required to repair potholes, ruts, and washboards and to restore the road's crown for proper drainage. Reshaping involves working the aggregate, sometimes to a depth of 8 inches or more, to achieve the proper blend of fines and stones of different sizes and then grading to achieve proper cross-slope. The motor grader must cut as deep as the deepest potholes, washboards, and ruts to prevent their recurrence.
- Reshaping a road should give it a cross-section in the shape of a flattened "A." The road should slope from its center, at ½ inch to ¾ inch per foot, to its outside edges.
- The surface should be compacted after blading or reshaping.

Other repair may include removing soft spots (geosynthetics can help here), fixing washouts, cleaning ditches and pipes, and improving drainage facilities.

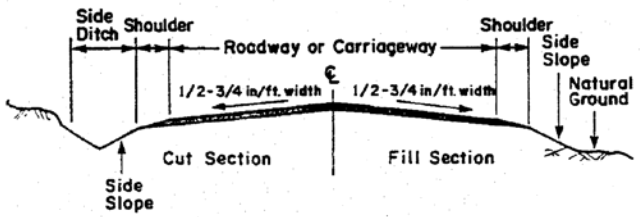
Blading and, if necessary, reshaping will reveal where you may need new aggregate. If, for some reason, you plan to place new aggregate where the road has maintained a hard surface, you must at least scarify (roughen) the road's surface to a depth of ½ to 1 inch. New aggregate won't "knit" to a hard, crusted surface, and the boundary between old surface and new aggregate could become a slip plane. A motor grader equipped with a carbide-tooth blade will scarify a surface well.

Installing and Compacting Aggregate

Your goal should be to prevent the aggregate from losing its moisture before compaction. To accomplish this, you must distribute the aggregate quickly and evenly and work it as little as possible with the motor grader. Therefore, you should consider distributing the aggregate with a spreader box or paver instead of dumping (tailgating) it directly onto the road from a truck. If you dump the aggregate, you'll have to work it more with the motor grader, which could dry it further and segregate it (separate the fines from the larger stones).

Here are the particulars for installing aggregate:

- Distribute a thickness of new aggregate so that the compacted depth can be 8 inches.
- If you use a spreader box or paver, keep the level of aggregate at or near capacity. Set the spreader box or paver to distribute the aggregate in a way that minimizes the grading needed to achieve uniform thickness and crown.



Typical cross-section of an aggregate-surfaced roadway.

- If you tailgate the aggregate, spread it to a uniform thickness along the center of the road in an amount that enables the motor grader to set a proper cross-slope from the center of the road to the edges with a minimum of passes for each travel lane.

Renting a compactor is worth the money it will save by preventing loss of aggregate. Compacting with a truck or not compacting at all is not recommended.

Here are some tips for compacting:

- Use an 8- to 10-ton (at a minimum), vibratory, steel-drum roller for compaction.
- Make overlapping, longitudinal passes with the compactor, beginning at the shoulder and working toward the crown. Don't run the roller along the top of the crown.

Using a Dust Suppressant

If you plan to use dust suppressants on your unpaved roads, they should be applied initially in the spring. Depending on the conditions or product, a second application may be needed in late summer or fall.

When choosing a dust suppressant, consider the following:

- Aggregate and other material on the road – Analyze the road and match suppressant to conditions.
- Traffic type, volume, and speed.
- Frequency of blading, reshaping, and other maintenance.
- Degree of dust control required.
- Climate and terrain – A road that is almost always in sun is different from a shaded road.
- The environment – Dust suppressants can negatively affect vegetation, streams, wetlands, and groundwater, depending on their characteristics and where and how they are applied.
- Corrosiveness to steel and aluminum structures along the road.
- Product and application costs.
- Product handling according to the Material Safety Data Sheet.
- Service life of the product.

Suppressants come in liquid or solid form. A list of approved dust suppressants can be found in PennDOT Publication 447.

Before applying the suppressant, check the weather forecast to avoid heavy rain. The road surface should be damp but not wet. If you are using cutback asphalt as a dust suppressant, the road should be dry.

Next, prepare the road. You should blade and, if necessary, reshape the road, make other repairs, and install aggregate if needed. Scarifying the road surface just prior to application may help the dust suppressant's performance since the procedure will diminish the amount of liquid suppressant that runs off the road and help both liquid and solid suppressants to penetrate.

Renting a compactor is worth the money it will save by preventing loss of aggregate.

Once a suppressant is applied, compact the scarified surface. Consult your supplier to determine whether scarifying is recommended for your dust suppressant.

If you are applying a liquid suppressant, consider distributing it from a truck equipped with a spray bar. A homemade applicator may result in applying too little for effective dust control or too much, which wastes money and may cause the dust suppressant to run into the roadside environment.

Solid suppressants come as flakes or chips, and the most common way to apply them is with the spreaders you use for deicing operations. Be sure to calibrate the spreaders first for an effective rate of application. The application rate will vary, depending on the product; condition of the road and wearing surface; volume, speed, and type of traffic; climate and weather; and frequency of maintenance. Work with your supplier to determine the appropriate rate to achieve the dust control you expect.

Finding Success

Dust control won't make a bad road good, but it will keep a good road in decent shape. The tips outlined in this tech sheet should help to ensure a stable, sturdy surface on your unpaved roads, obtain longer service from those roads, and reduce the need for replacement aggregate and frequent repair.

Contact LTAP at 1-800-FOR-LTAP (367-5827) or **www.ltap.pa.us** for further information about aggregate, dust suppressants, and the maintenance and construction of unpaved roads.

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